

CLAIMS

- 1) A method for determining variations of resistivity index (RI) of a family of rock samples of complex pore structure as a function of the water saturation (S_w), in the presence of a non-conducting fluid, comprising the following stages :
 - 5 - for each sample of the family comprising at least a first and a second pore network, determining the volume fraction (f_1, f_2) occupied by each pore network by applying to the various samples an NMR type relaxometry technique,
 - for each sample of the family, measuring by mercury injection the pore throat distribution in the various pore networks,
- 10 - determining experimentally on a sample at least of the family used as reference the values of coefficients (n_1, n_2) relating the variation of its electrical resistivity as a function of its water saturation (S_w), and
- determining the resistivity index (RI) of all the samples of the family on the basis of the variation of parameters describing the layout of the pore network (f_1, f_2, S_c, S_m) and
- 15 using the values of said coefficients measured on the reference sample.

- 2) A method as claimed in claim 1, characterized in that the values of the coefficients (n_1, n_2) relating the total conductivity (C_t) of the sample to the conductivity (C_1, C_2) of the first and second pore networks and to the respective water saturations (S_{w1}, S_{w2}) of the two networks are determined from the reference sample, the resistivity index being calculated from the respective volume fractions (f_1, f_2) of the two pore networks and from the value of the mean saturation (S_c) from which the network with the smaller pores is invaded by the non-conducting fluid.

3) A method as claimed in claim 1, characterized in that, for a sample comprising a third pore network, the values of the coefficients (n_1 , n_2) relating the total conductivity (C_t) of the sample to the conductivity (C_1 , C_2) of the first and second pore networks and to the respective water saturations (S_{w_1} , S_{w_2}) of the first two networks are determined
5 from the reference sample, the resistivity index being calculated from the respective volume fractions (f_1 , f_2 , f_3) of the three pore networks, from the value of the mean saturation (S_c) from which the network having the smaller pores among the first two pore networks is invaded by the non-conducting fluid, and from the value (S_m) from
10 which the network having the larger pores among the first two pore networks is invaded by the non-conducting fluid.